THE ENGINEER.

The British Industries Fair at Birmingham.

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Introduction.

ENGINEERS must view the progress of the British Industries Fair with mixed feelings of satisfaction and dissatisfaction. The Engineering and Hardware Section, which will open at Castle Bromwich on May 20th and close on May 31st, is being held this year subsequently to the remainder of the Fair. The fact that it is larger than it has ever been before and that it has been found necessary to increase the indoor space to the extent of 9000 square feet is a satisfactory indication, not only of the success of the policy of holding this section of the Fair at a later date than usual, but also of the increasing prosperity of the country. But at the same time it is permissible to regret that as the years pass by the Fair seems to become of lesser and lesser interest to the heavier engineering industries. In this year's Fair, as in a few days' time visitors from various parts of the world will discover, there is no lack of exhibits of a very varied character in the lighter classes of engineering. Those interested in such things as valves and other engineering fittings, in beltings and joint packings, in small engineers' tools and in small mechanical devices that may form a part of larger machinery, will find plenty of exhibits on which to occupy their time. In electrical engineering, too, the same remarks are true. There are plenty of instruments and relays; many fractional horse-power motors, small rectifiers, and electrical fittings applicable particularly to the smaller factories and the home. But the products of the heavier engineering firms are for the most part absent.

We do not intend by the foregoing comments to suggest that the Fair will be lacking in interest. The growth of its success from year to year is a sure demonstration that it serves a highly useful purpose. Nor do we intend any criticism of the heavier engineering firms in that they do not take space at Castle Bromwich. The unanimity with which they abstain is proof, if proof is needed, that adequate reason exists. What we do wish to express, however, is our conviction that in recent years the British Industries Fair has failed to give a true impression of the range of British engineering, and we can but hope that foreign visitors, especially those visiting these shores for the first time, will not carry away with them, by reason of the misleading title of the Fair, a wrong conception of the engineering importance of these islands. It will be appreciated from the foregoing that if in the descriptions of the exhibits appearing in this Supplement, in the issue it accompanies, and in a Supplement which will be published with our next issue there appears a singular lack of notice of heavier engineering productions, it arises, not through any fault of ours, but rather because such productions are poorly represented at the Fair. As far as possible in writing the descriptions for our articles on the Fair we have endeavoured to give a true impression of what the visitor will see, stressing especially what appeals to us as novel or for some other reason of particular interest. For those who are able to visit the Exhibition grounds themselves these pages may act in some sort as a guide. Others, less fortunate, may, we hope, in the reading of them, gain some conception of the scope of the Exhibition.

The British Oxygen Company, Ltd.

There will be a new feature on the stand of the British Oxygen Company, Ltd., Victoria Station House, Westminster, in the form of a special blow-pipe for building up metal on to railway and tramway rails. We give an illustration in Fig. 1 of one of these blow-pipes in service, from which it will be seen that three adjacent jets of flame are employed.

Fig. 1—Three-Jet Nozzle in Use for Rail Surfacing—British Oxygen

A special rod having a high percentage of manganese and chromium and a moderately high percentage of silicon, and having wear-resisting properties, is used for this work. It is deposited using the oxy-acetylene flame, having a definite excess of acetylene, and the surface of the rail where the deposit has to be made is not melted as it would be in the normal welding process, but only brought to a state of surface fusion, owing to the lowering of the melting temperature of the surface of the rail by the absorption of the carbon from the excess acetylene flame. It may be thought that as the deposit and the rail are not fused together in the normal welding manner, there is a danger of the deposit flaking off entirely, but extensive tests and actual experience in practice, the firm claims, prove that this is not so, and that there never has been an instance of the deposit fracturing at the joint between the deposit and the rail. One of the advantages of the oxy-acetylene process is that the deposit is put down in a plastic condition and can be maintained in that state by heating with the blow-pipe, so that it is possible to hammer-dress the surface, thereby smoothing out the ridges which may be left after welding. In practice it is desirable first to heat the rail, to deposit a small amount of metal, and then to hammer that metal to the required shape. English practice is not to resurface any crossings which have worn more than $\frac{3}{4}$in., and this thickness of deposit can be laid down in one run.

As it is important to lay the deposit as smoothly as possible in order to minimise the amount of hammering that has to be done to produce a smooth surface, a new type of three-jet nozzle has been designed for this work. The single nozzle tends, of course, to concentrate the heat too much and produce acute ridging owing to the agitation of the molten metal; but the new three-jet nozzle, of which we give an illustration in Fig. 1, overcomes this difficulty by giving better heat distribution, enabling a large area to be heated quickly, and with very little blow-pipe movement. The three-jet nozzle is used for all large surfaces, such as the wing rails, but for the point rail, which is narrow, the ordinary single-jet blow-pipe is employed. The oxy-acetylene deposit is very ductile without being hard, and does not flake or crack under shock; the actual hardness of the deposit in Brinell numbers is from 270 to 300 and the deposit does not get harder as it wears.

It is stated by the British Oxygen Company that no arc or oxy-acetylene welded rail joints are in actual service in running roads, although a few arc-welded joints were installed some years ago in some little-used sidings at Stratford, L.N.E.R., and all these joints failed by cracking through the weld. In the cases where a sole plate was employed, the fillet welds cracked and the sole plates fell off.

According to the firm, the arc-welded joints which have been submitted for tests up to the present have been of two types (*a*) the butt rail joint with sole plate, and (*b*) the butt rail joint with an interposed plate between rail ends and sole plates. The oxy-acetylene joints tested up to the present have all been plain butt-welded rails. The results of the tests on arc and oxy-acetylene deposits compare very favourably; in fact, there is very little difference between them. Only two oxy-acetylene joints in standard rail have been tested, but in neither of these cases did the loading cause the rail to deflect beyond the elastic limit—that is, as far as can be ascertained, very little permanent set took place. In the case of the arc-welded joints the rail deflected considerably for 10 tons or so of loading just prior to breaking. It is considered that the majority of this deflection took place in the rail, as the joint was very stiff owing to the sole plate. All the oxy-acetylene-welded joints broke through the weld.

The company will also be showing some apparatus for spraying zinc on to other metal surfaces of a high melting point.

Crompton-Parkinson, Ltd.

Lamps and V.I.R. cables will be exhibited by Crompton-Parkinson, Ltd., of Bush House, W.C.2. In addition to high-candle-power lamps up to 1500 watts, domestic lamps ranging from $\frac{1}{4}$ to 60 watts and $\frac{3}{4}$ to 100 watts, are being shown. The Kye range covers 25, 40, 60, and 100 watt lamps in seven standard voltages.

The V.I.R. cables made by Derby Cables, Ltd., and marketed by the lamp and cable department of Crompton Parkinson, Ltd., include all the important types of cables and several special types. Derite braded and unbraded and Derite C.T.S. cables are to be shown. "Derite" is a tough, elastic, and resilient compound, which resists the effects of moisture, sunlight, high temperatures, acids, and alkalis, and is unaffected by plaster, cement, and concrete. It is claimed to be practically non-perishing. Another product to be shown is Derbel bell wire, which is claimed to be superior to the ordinary cotton-covered, paraffin-

waxed bell wire, especially when used in damp situations. It consists of high-conducting, tinned copper wire, insulated with vulcanised rubber, and in the case of twin wire the two cores are held together side by side, the outer covering of one being square and that of the other circular, so that they can readily be distinguished, even in the dark.

CAMBRIDGE INSTRUMENT COMPANY, LTD.

Temperature measuring and controlling instruments, electrical measuring instruments, apparatus for use in connection with power plant, gas analysis apparatus, and physical measuring instruments, are to be exhibited by the Cambridge Instrument Company, Ltd., of 45, Grosvenor-place, S.W.1. One of the new instruments is a scratch extensometer—Fig. 2—for obtaining records of tension and compression in struts, girders, flat metal surfaces, &c. The instrument is very small and light, and may readily be attached to almost any form of structure. It consists of two members, held together by a friction clip and capable of moving in one plane relative to one another. One member comprises a stylus which scratches a record on a polished plate or "target" carried on the other member, the target being automatically traversed at right angles to the movement of the stylus whenever extension or compression takes place in the girder to which the instrument is attached. Extension bars can be supplied which increase the base length over which the instrument operates with consequent gain in sensitivity. The instrument is less than 4in. long, and weighs less than 1 oz.

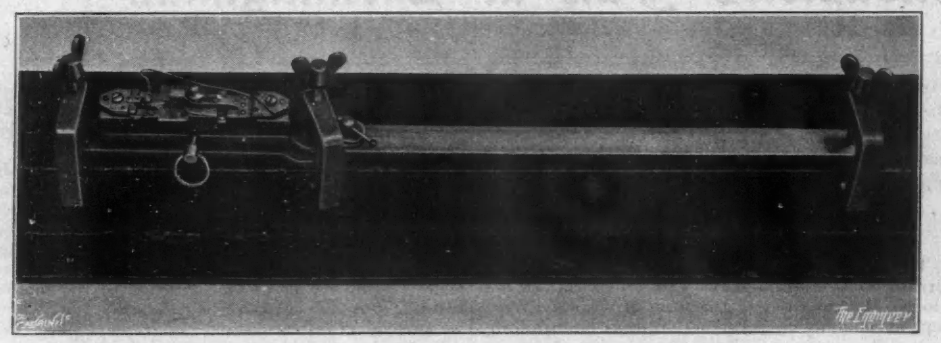

FIG. 2—SCRATCH EXTENSOMETER—CAMBRIDGE

Among the instruments for measuring high temperatures there will be a disappearing filament pyrometer—Fig. 3—designed to facilitate the measurement of molten steel temperatures. The optical magnification is increased some threefold above that of the standard instrument, while the shape of the filament and other details have been modified to facilitate taking quick and accurate readings. A metal shield with a red glass screen protects the "idle" eye of the observer from the glare of the molten metal.

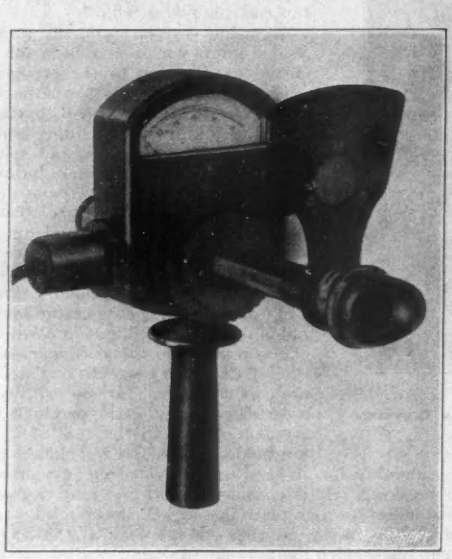

FIG. 3—DISAPPEARING FILAMENT PYROMETER—CAMBRIDGE

Among the power plant instruments examples of the latest electrical CO_2 meters, the dissolved oxygen meter as supplied to the Battersea, Barking, and other super-power stations, and a smoke recorder for recording the density of smoke in the gases emitted to the atmosphere by way of power plant chimneys will be shown.

CHASESIDE ENGINEERING COMPANY.

One of the exhibits of the Chaseside Engineering Company, of Enfield, Middlesex, will be a useful small-size mechanical shovel. This device consists of an adjustable scoop mechanism. It is fitted to and supplied as a unit with a suitable tractor, and the complete machine can be seen in Fig. 4.

The tractor adopted develops 30 b.h.p. at 1000 r.p.m., and is designed to consume $\frac{3}{4}$ gallon of No. 3 spirit per hour. The maximum forward speed is about 10 m.p.h., and the turning circle is of $3\frac{1}{2}$ yards radius. Three constant-mesh forward gears and one reverse are provided. On the tractor chassis is mounted a framework of electrically welded mild steel, 5in. by $2\frac{1}{2}$in. channel, which carries the scoop arms of 6in. by 3in. steel. The arrangement permits the raising and lowering of the scoop over a height range of 9ft. for unloading, so that the shovel can discharge straight into a railway truck if needs be. The rate of economical working of the machine is given as from 5 tons per hour to 40 tons per hour, and it is claimed that the cost works out at about 1d. per ton shifted. The operation and manœuvring facility of the machine is equal to that of an ordinary tractor. A safety brake is fitted to the tractor which prevents the driver moving it accidentally. The simple operation of the scoop by two levers enables the ordinary tractor driver to handle the excavator. The use of pneumatic tires should overcome any tendency to slide on the part of the tractor on slippery ground in clay pits, &c. Spare parts for the tractor, which is of a well-known make, are easily obtainable at any garage, and the scoop mechanism, being a simple pulley system, is designed for very simple maintenance.

FIG. 4—MECHANICAL SHOVEL—CHASESIDE

MILLARS' MACHINERY COMPANY, LTD.

An interesting demonstration will be arranged on the stand of Millars' Machinery Company, Ltd. Five of the exhibits connected with road-making and contractors' machinery are to be shown running under working conditions for demonstration purposes. The first running exhibit will be the 5/$3\frac{1}{2}$ S T concrete mixer. Operated by the Millars'-Bamford $1\frac{1}{2}$ h.p. vertical hopper-cooled petrol engine, this exhibit consists of the firm's patented triple-purpose tilting mixing drum for producing concrete, mortar, or plaster. The drum is mounted on two double-angled road wheels by means of a specially designed frame. Its average working capacity is 20 to 25 cubic yards of mixed concrete per eight-hour day. The engine is of the firm's hinged crank case type, which enables an inspection of all working parts to be made without dismantling the engine. Next, the 6/4 L type mixer will be shown. This mixer, driven by a 3 h.p. engine of the same make, has the same pattern drum, but of 36/45 cubic yards capacity, fitted with a power-operated side loader with automatic single lever control and an automatic vibrating device for quick emptying of the bucket. A revolving self-measuring water tank is also fitted and the whole machine is mounted on a four-wheel chassis with draw gear. The third mixer is the 10/7 N T type, the high-speed rotary non-tilting drum of which is driven by a 5 h.p. Millars'-Bamford engine. This model is built for very high outputs and has a quick-lift charging hopper, automatic vibrator on the loading bucket, revolving self-measuring water tank, and four-wheeled chassis. Its capacity is 80/100 cubic yards of concrete per eight-hour day. Also to be seen running will be the Millars' overdriven roller pan mixer for handling mortar, either compo, sand/lime, or black varieties. It is operated by the firm's 5 h.p. petrol engine, and is easily movable on its four-wheeled chassis. Finally, the firm will be running a 3in. single-diaphragm pump operated by a 2 h.p. engine. It has a capacity of 5000 gallons per hour. Millars' Machinery Company will also show its new highways maintenance mixer, which is illustrated in Fig. 5. This machine is designed for hot asphalt and bituminous macadams, and is suitable for binder, course and wearing surface. It is fitted with the firm's dual-purpose drum for drying and mixing and is operated by a 4 h.p. Lister-Diesel engine. It has a batch capacity of 5/7 cubic feet.

FIG. 5—HIGHWAYS MAINTENANCE MIXER—MILLARS'

JOSEPH LUCAS, LTD.

Lucas products and those of its associated companies, including car electrical equipment and accessories, wireless, and aircraft equipment, will be shown by Joseph Lucas, Ltd., of Great King-street, Birmingham. An improved device that is fitted to the firm's replacement batteries is the Prismatic acid level indicator, which consists of two small circular windows let into the lid of each cell. When the acid is at the correct level one window is dark and the other light, whilst when the acid falls below the proper level, both windows are light, thus indicating that the cell should be "topped up." Another new feature of the firm's accumulators is a reinforced cell partition, which eliminates the possibility of inter-cell leakage. The material of which these partitions are composed is an extremely tough compound, which is unaffected by sudden changes of temperature and which does not crack. New non-sulphating cable connectors shown are composed of a special alloy which is claimed to resist sulphation under the worst conditions.

A new motor car windscreen-spraying device projects twin jets of liquid on to the screen in order to wash away dried mud, dust, &c., thus enabling the wiper to make a really wet wipe on the first stroke. New electric horns exhibited give mellow notes, one loud and one medium for country and town

driving conditions. Among many other exhibits are Lucas lighting, starting, and ignition equipment to suit all kinds of cars.

NIAGARA SCREENS (GREAT BRITAIN), LTD.

The screen which we illustrate in Fig. 6 will be displayed by Niagara Screens (Great Britain), Ltd., of Straysfield-road, Clay Hill, Enfield, Middlesex.

The characteristic of this screen lies in the fact that it is given a definite rotary movement in a vertical plane by an excentric shaft. This action is said to make the pieces of material being handled rotate in the opposite sense to the way in which they

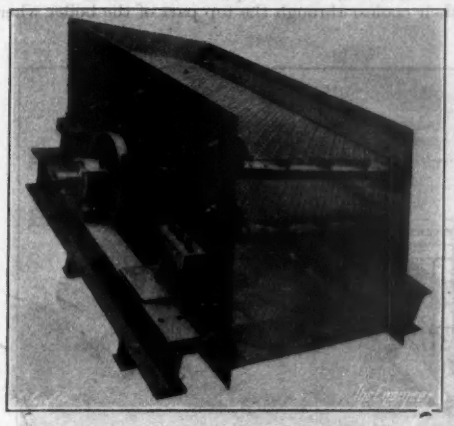

FIG. 6—VIBRATORY SCREEN—NIAGARA

are flowing forward, and effects a very high degree of classification.

The main driving shaft, the end of which is plainly shown in the engraving, runs in roller bearings and has an excentric portion within the side plates of the screen. This part also carries two roller bearings, which are attached to the side plates. The result is that the screen is forcibly vibrated, but the reaction is not transmitted to the frame as the shaft also carries two fly-wheels, which are made out of balance to produce the desired effect.

The screen shown has, it will be seen, three decks, measuring 40in. by 120in., and will handle 200 tons of iron ore an hour, grading it into four sizes. The speed of vibration is about 1200 per minute, and the driving power required 5 h.p.

BROOM AND WADE, LTD.

After so many years of continual development it is illogical to expect to observe any great, or so-called revolutionary, improvements in air compressors.

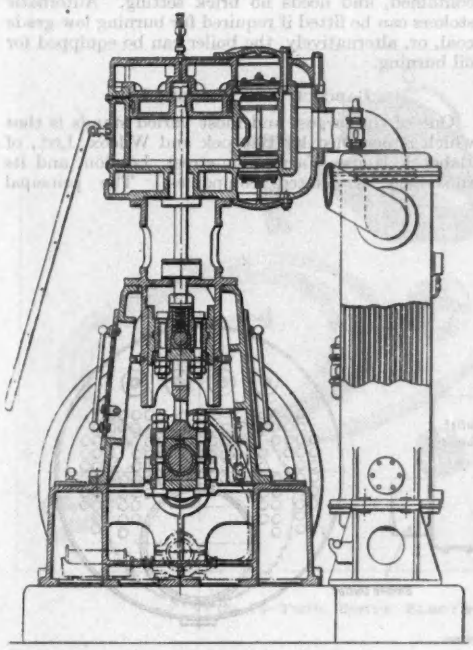

FIG. 7—AIR COMPRESSOR—BROOM AND WADE

Thus the new double-acting two-stage machine to be seen on the stand taken by Broom and Wade, Ltd., of High Wycombe, will show no startling developments. At the same time, a close examination will demonstrate that thoughtful attention has been applied to the design of every detail, while the importance of good workmanship has been fully recognised. For instance, the arrangement of inspection doors is such that every working part, although totally enclosed at work, is readily accessible, not only for inspection, but also for adjustment. Forced feed lubrication is becoming normal practice on reciprocating machinery nowadays, so that no special claims may be made in that direction. But in less obvious ways, such as the design of the cooling system, which is so arranged that the cooling is particularly thorough at just those places where cooling is most necessary, the machine deserves attention. The plate valves, it should be noted from the drawing, Fig. 7, are placed in chambers on the side of the cylinder, where they are completely surrounded by water jackets. The makers state that they have given special attention to the design of the valve seats with the object of obtaining the largest possible port areas and of securing great reliability with a small plate valve supporting area. In the result the delivery valves open when the pressure of the air in the cylinders is very little in excess of that in the air receiver, and the wastage of power prevalent in some designs in attaining the higher pressure necessary to lift the valves is obviated. Moreover, owing to the careful design and arrangement of the valves, the cylinder clearance is reduced and high volumetric efficiency obtained. This type of compressor is made in six sizes with delivery capacities from 320 cubic feet to 2500 cubic feet of free air per minute. The standard working pressure is the same for each size at a maximum of 120 lb. per square inch.

ALFRED HERBERT, LTD.

On one of the two stands taken by Alfred Herbert, Ltd., of Coventry, there will be seen an Atritor firing two furnaces, one for heating small bars for the manufacture of bolts and rivets and the other for general forging and stamping work. An elevator transfers the coal to an overhead bunker, whence it passes to the Atritor, which dries it and pulverises it and discharges it into a cyclone separator. The coal here falls into a receiver while the air passes either to a bag filter or to the primary air fans. A feeder delivers the pulverised fuel to the furnaces, and as it is driven by a variable speed motor, use may be made of a thermostat to control the motor regulator and thus the temperature of the furnace. It is claimed for this system of firing that a mellow soaking heat is obtained with a non-oxidising flame; that no banking and cleaning of fires is necessary; and that both capital and labour costs are low. Besides to furnaces for heating ingots, billets, rolling, tube drawing, and heavy forgings up to 60 tons in weight, the Atritor has also been applied to tin, lead, copper and brass furnaces.

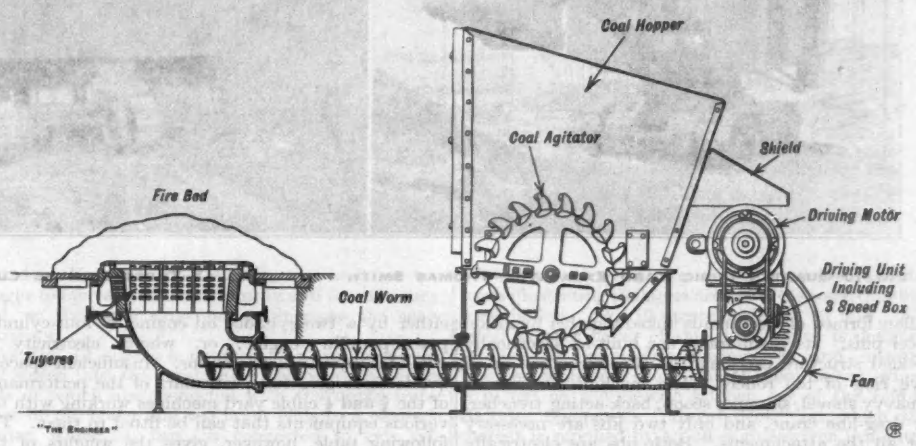

FIG. 8—SECTION THROUGH THE "IRON FIREMAN" AUTOMATIC STOKER—HERBERT

On the same stand there is to be exhibited the Iron Fireman automatic stoker, the arrangement of which is to be seen in Fig. 8. It is suitable for firing metallurgical furnaces and small boilers. The coal in the hopper is kept in motion by an agitator, which causes it to enter a worm conveyor. It is fed into the furnace from below the fire, and as it approaches the latter it is gradually heated. The volatile gases thus released pass upwards through the fire to burn, while the residue as it rises into the region of combustion is also consumed. It will be noticed from the drawing that air enters the fire through tuyeres surrounding the top of the "mouth" through which the coal emerges on to the fire bed. The whole affair is operated by a small electric motor, which besides driving the feed worm through a suitable gear-box with three ratios, also drives the fan delivering air to the tuyeres. The device is easily controlled by thermostatic or other relays to maintain a constant furnace temperature or boiler pressure.

Both the devices just described will be seen on the same stand. On the other stand taken by the firm there will be exhibited a wide range of small tools, such as Coventry Tangic self-opening dieheads and dies, air chucks and vices, Ardaloy tipped tools, friction clutches, broaching tools, and many other accessories, many of which at one time or another have been described in the pages of THE ENGINEER.

THE STANDARD AND POCHIN BROTHERS, LTD.

The firm of the Standard and Pochin Brothers, Ltd., of Evington Valley-road, Leicester, will be exhibiting a range of Calorier unit heaters. These heaters, the construction of which is shown in Fig. 9, are designed to give a scientific distribution of heat in large workshops, halls, &c., by making use of a directed downward air flow from a fan situated behind a steam heater to the floor. The cold air displaced upwards by this downcoming air is again heated and circulated downwards. Thus, the natural condition of a building, namely, hot air at the roof level and cold air below, is made use of, but the entire atmosphere of the shop is kept in circulation constantly. The heater itself consists of a radiator of the gilled copper tube type at the back of which is an electric fan. In front is a series of directing vanes, each separately adjustable for angle. The radiator is strongly built, the headers being cast iron, while the gilled tubes are of patented

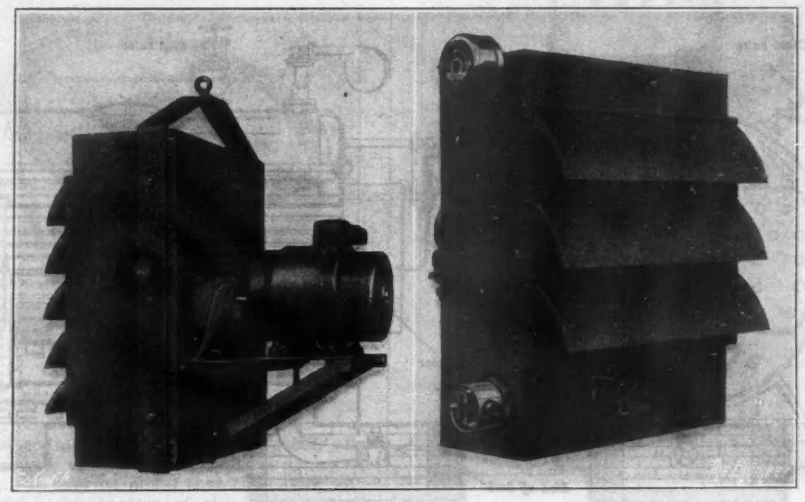

FIG. 9—"CALORIER" UNIT HEATER—STANDARD AND POCHIN

construction, which makes each tube and its gills a solid body. The heater unit is tested to withstand a pressure of 300 lb. per square inch, while the recommended pressure of the steam supply is 100 lb. per square inch. The fan, which has been designed to deal with a large air volume, is strongly constructed, the lower part of each blade being part of the hub itself, thus preventing distortion of the blade angles. The whole unit is encased in a sheet steel shell. There are a variety of uses to which this heater can be put, as the heater elements can

be built up in batteries with larger fans, enabling trunk ventilating systems or drying cupboards to be heated. Air filters can be readily fitted to the inlet side, while to obtain automatic temperature control the firm is marketing a thermostat switch for the fan circuit. For small installations, where steam is not available, an electric heater element will be on view, and is a useful adjunct to this range of products.

THOMAS SMITH AND SONS (RODLEY), LTD.

Among the excavators to be seen at the Fair one of the most interesting will be the quarter-cubic-yard machine made by Thomas Smith and Sons (Rodley), Ltd. This machine, shown in the illustration, Fig. 10, fitted with a skimmer scoop, is mounted on caterpillars formed of steel treads linked together by nickel steel pins. Its main frame is a built-up electrically welded structure carrying the superstructure on a live ring of ten rollers. The machine can act as a navvy shovel, skimmer scoop, back-acting trencher, or drag-line crane, and only two jibs are necessary for all the attachments. Both jibs are electrically welded steel box sections, and all the attachments can be readily interchanged at the site of work. The machine can be driven either by a high-speed, two-stroke, twin-cylinder oil engine, with a fuel consumption of about $\frac{1}{2}$ gallon per hour, or by a four-cylinder petrol or paraffin engine, with a consumption of $\frac{3}{4}$ gallon per hour. It gives a digging pull of $3\frac{1}{2}$ tons at 90ft. per minute, a slewing speed of 6 r.p.m., and a travelling speed of $\frac{3}{4}$ mile per hour. The excavator has a total weight in working order of $6\frac{3}{4}$ tons, amounting to a bearing pressure on the ground of 9 cwt. per square foot. As a crane it will lift 22 cwt. at 10ft. radius, or 12 cwt. at 16ft. radius.

The other machine illustrated working as a navvy in Fig. 11 is of $\frac{3}{8}$ cubic yard capacity. Its construction is similar to that of the $\frac{1}{4}$ cubic yard machine. Power for travelling is transmitted by totally enclosed bevels and special forged steel chains, and two speeds are available. Each track is independently controllable from the driver's position. The path with its machined face for taking the live ring of rollers is combined with the slewing rack, the teeth of which are machine cut from the solid. Two rope barrels are carried on separate shafts on the centre line of the machine. By this means rope leads are centralised and side thrusts eliminated so that tapered barrels are unnecessary. Deep machined grooves retain the shape of the rope. Power is transmitted to the barrels by fibre-lined clutches which, in turn, are operated by shoe clutches. The arrangement is such that the power of the engine is utilised for operating the main clutches, with the result that little effort is required to move the hand levers. The barrel brakes are made in halves which are interchangeable. All the control levers are grouped near the driver at the front of the machine, those most frequently used being placed in front. The $\frac{3}{8}$ cubic yard excavator, and also the $\frac{1}{4}$ cubic yard machine, which is similar in almost every respect, is driven either by a two-cylinder oil engine, a four-cylinder petrol/paraffin engine, or, where electricity is available, by an electric motor. Insufficient space is available to give full particulars of the performance of the $\frac{3}{8}$ and $\frac{1}{4}$ cubic yard machines working with the various equipments that can be fitted to them. The following table, however, gives the weights of the machines as equipped for several purposes :—

With following equipment.	Type $\frac{1}{4}$ yard. Tons.	Type $\frac{1}{4}$ yard. Tons.
Navvy shovel	$10\frac{3}{4}$	$16\frac{1}{2}$
Skimmer scoop	$11\frac{1}{2}$	$17\frac{1}{4}$
Back-acting trencher	$11\frac{1}{2}$	$17\frac{1}{4}$
Dragline	12	$17\frac{1}{4}$
Crane	$11\frac{1}{4}$	$16\frac{3}{4}$
Grabbing crane	12	$17\frac{1}{4}$

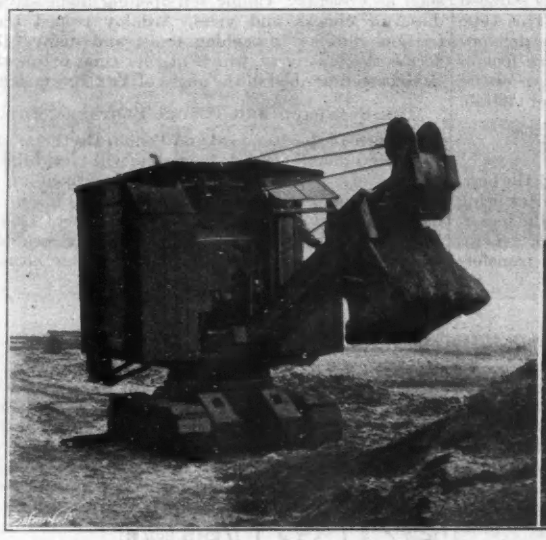

FIG. 10—QUARTER CUBIC YARD EXCAVATOR—THOMAS SMITH

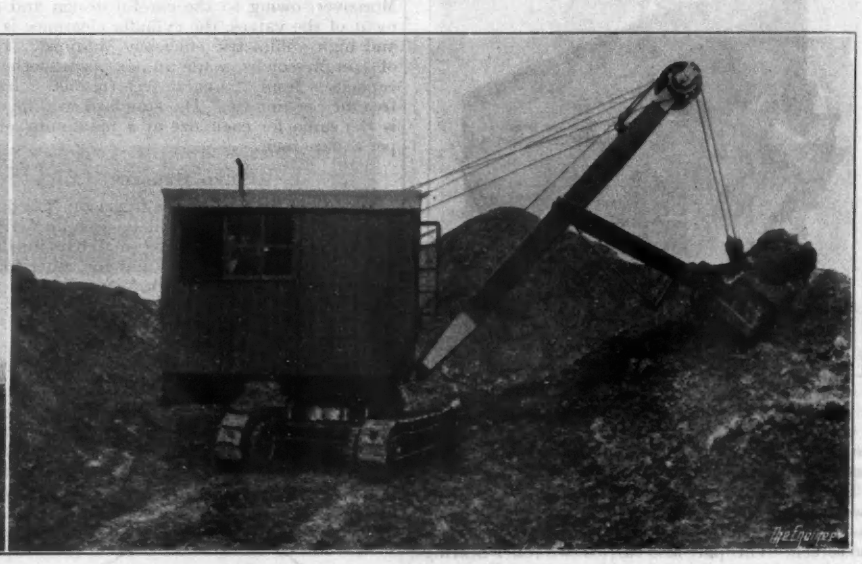

FIG. 11—THREE-EIGHTHS CUBIC YARD EXCAVATOR—THOMAS SMITH

RUSTON AND HORNSBY, LTD.

ON one of the stands taken by Ruston and Hornsby, Ltd., of Lincoln, there will be exhibited for the first time a new boiler, drawings of which are reproduced in Fig. 12. In designing this new steam generator, the firm has had as its object the production of a type giving a greater efficiency than any other shell boiler hitherto available. It may, we understand, be regarded as an alternative product to the vertical Thermax boiler made by the firm, and is suitable for use where headroom is a consideration, while the vertical type can be accommodated when the floor space is limited. From the drawings it will be observed that the boiler has a wet back combustion chamber and two sets of fire tubes. This arrangement has the advantage as compared to a brick-lined chamber, that there is no radiation to the surrounding atmosphere, so that all the heat which is taken from the gases at the combustion chamber is transferred to the water. The products of combustion pass through the boiler flue to the combustion chamber, thence through one bank of tubes to the smoke-box at the front, returning to a chamber at the rear of the boiler through another set of tubes. This second set of tubes is divided into two nests, arranged on either side of the wet back combustion chamber, and at the same level as the first set of tubes. This arrangement avoids taking the final pass where the gases are at their coolest through the top part of the boiler where the water is at its highest temperature. The rear end chamber is, of course, connected to a chimney. It is interesting to observe that a cleaning hole is provided in the smoke-box for every four tubes. Through these holes the tubes can be cleaned while the boiler is under steam, with a consequent saving of time. Nor is there remaining any excuse for the fireman allowing the tubes to become dirty. This type of boiler is made in a range of sizes from 1000 lb. evaporation upwards, and it is claimed that its overall dimensions are considerably less than those of other types of boiler of similar capacity. It is entirely self-contained, and needs no brick setting. Automatic stokers can be fitted if required for burning low-grade coal, or, alternatively, the boiler can be equipped for oil burning.

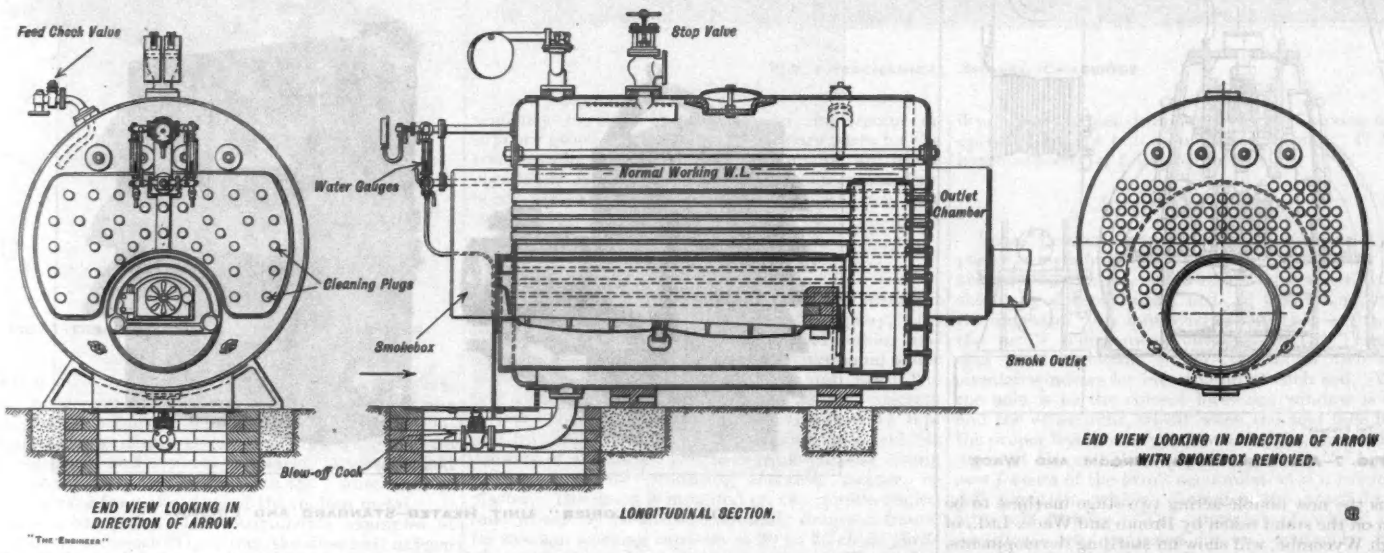

FIG. 12—DETAILS OF HORIZONTAL BOILER WITH WET BACK COMBUSTION CHAMBER—RUSTON

BABCOCK AND WILCOX, LTD.

One of the largest and most varied stands is that which is occupied by Babcock and Wilcox, Ltd., of Babcock House, Farringdon-street, London, and its subsidiary associated companies. The principal Babcock exhibit will be a twin, 33ft. wide, 20ft. long, chain grate stoker, one of eight that are being supplied to the Klip generating station of the Electricity Supply Commission of the Union of South Africa, which is operated by the Victoria Falls and Transvaal Power Company, Ltd. This stoker, which is exhibited as a complete unit, is claimed to be the largest B. and W. stoker in the world.

A full technical description of it will be found in THE ENGINEER of April 19th, 1935.

New developments in fusion welding will be represented by a series of X-ray films, and test specimens of all kinds, and the application of this process is to be illustrated by a full-size small economiser of the firm's flash-welded type. Other items will include a gravity bucket conveyor, which is a full-sized working exhibit, and examples of the Babcock "Handor" parallel slide valve, which gives the maximum accessibility for examination and is designed and manufactured for use with high-pressure and high-temperature steam. Various patterns of oil-burning equipment are also to be shown.

From among a large exhibit of tube-cleaning tools we have chosen for illustration the twin-drive electric tube cleaner shown in Fig. 14. This machine is recommended for use in cases where a high rate of scaling is required and where two different installations require to be dealt with at the same time. The gear-box can be designed to give the same speed on both shafts or, more usually, two speeds, say, 3000 r.p.m. for small diameter tubes in condensers and evaporators, and 1500 r.p.m. for boiler and economiser tubes. The type of motor can also be adapted for all speeds and voltages. The gears are totally enclosed and are automatically lubricated, a visible oil level gauge being supplied. The spindles from the gear-boxes are of nickel steel, hardened and ground, and have squared ends, while ball and roller bearings are used throughout. In the case of A.C. motors, there is a remote-control panel with a push-button starter, and for the D.C. motor units a semi-enclosed resistance type of starter is used. The new electrical tube cleaners are complete with a wide range of cutter heads designed for different classes of work. Other exhibits on this stand will be those of the Stirling Boiler Company, Ltd., Spencer Bonecourt, Ltd., and Erith's Engineering Company, Ltd., which will be represented by a selection of photographs and drawings giving examples of recent installations of boilers, waste-heat plants, and retort-type stokers carried out by these three firms.

The Calorizing Corporation of Great Britain, Ltd., will show a series of oil-cracking stills, annealing pots, and other articles, which have been rendered heat-proof by driving aluminium into the surface of the metal, thereby forming a surface of ferro-aluminium alloy, which, it is claimed, is immune to oxidation up to a maximum temperature of about 1750 deg. Fah., and, at the same time, completely resists the attack of sulphurous acids. Other exhibits include a series of tube supports and tube hangers for oil stills which are made of Calmet metal, a cast chromium-nickel-aluminium alloy steel which possesses extreme stiffness at all temperatures up to a safe working limit of about 1050 deg. Cent., and is resistant to all ordinary products of combustion.

A noteworthy boiler exhibited will be the new economic fire and water-tube boiler shown by Edwin Danks and Co. (Oldbury), Ltd., which represents a new development in land boiler design. It is illustrated in Fig. 13. In designing this boiler it was sought to increase the steam output and the efficiency, and, at the same time, not to increase the space taken up.

As Fig. 13 shows, a number of water tubes are introduced into the combustion chamber, the upper ends of which are connected with the upper water space of the boiler and the lower ends to a common header, which, in turn, is connected to two side headers attached to the bottom of the boiler shell by a series of nipples. Such an arrangement provides additional heating surface without encroaching upon the space that would be required by an ordinary type of economic boiler. Further, the water tubes being situated in the combustion chamber and being in intimate contact with the hottest gases, allow for a higher rate of heat transfer with a more rapid circulation. It may be noted that the colder water is drawn from the bottom of the boiler, thereby quickly ensuring a more uniform temperature throughout.

It is the makers' claim that this new arrangement not only improves the circulation and steaming capacity of the boiler, but it enables steam to be produced at a quicker rate and reduces the unequal expansion strains which have hitherto been experienced in the ordinary type of boiler.

The design is one which, moreover, allows for a convenient superheater arrangement, with good accessibility to all parts, as both the superheater and the water tubes are enclosed in a steel-panelled, fire-brick-lined combustion chamber, the panels of which can be quickly removed for tube inspection. The tubes are of a conical form and few spares need be carried. The boiler we have described can be designed for working pressures up to 250 lb. per square inch, and can be fitted for hand or mechanical firing. One of these new boilers, we are informed, has now been on constant service for a considerable period, and when recently opened up it was found to be very clean in all parts. The estimated steam output of the boiler we illustrate in Fig. 13 is about 7000 lb. per hour from cold feed, or about 20 per cent. above the normal evaporating capacity of a standard economic-pattern boiler.

On the stand of Babcock and Wilcox, Ltd., Clarkson Boilers, of 613, Australia House, Strand, London, W.C.2, will be exhibiting several models and boiler parts illustrating the latest designs of Clarkson thimble-tube boilers. We illustrate in Figs. 15 and 16 a small silencer boiler of this type, which is designed for use on oil-electric locomotives and railcars. The line engraving shows one of these boilers, which is in use on the electric kitchen car of the L.M.S. Railway Company's "Royal Scot," on which the current is supplied by an oil-engine-driven generator set. Other exhibits will illustrate the method of electrically welding the boiler seams, while a series of thimble tubes, varying in length from 24in. to 2½in. for large and small boilers, and in diameter from about 4in. to 1in., will be on view. A large photograph will serve to illustrate the latest pattern of Clarkson vertical oil-fired thimble-tube boiler, one of a series of standard types for land and marine use, and for coal, gas, or oil firing. The boiler referred to has a diameter of 5ft. 6in. with a height of 13ft., and with a heating surface of 220 square feet is designed to produce about 1750 lb. of steam per hour at 100 lb. pressure when working with oil firing. The boiler is

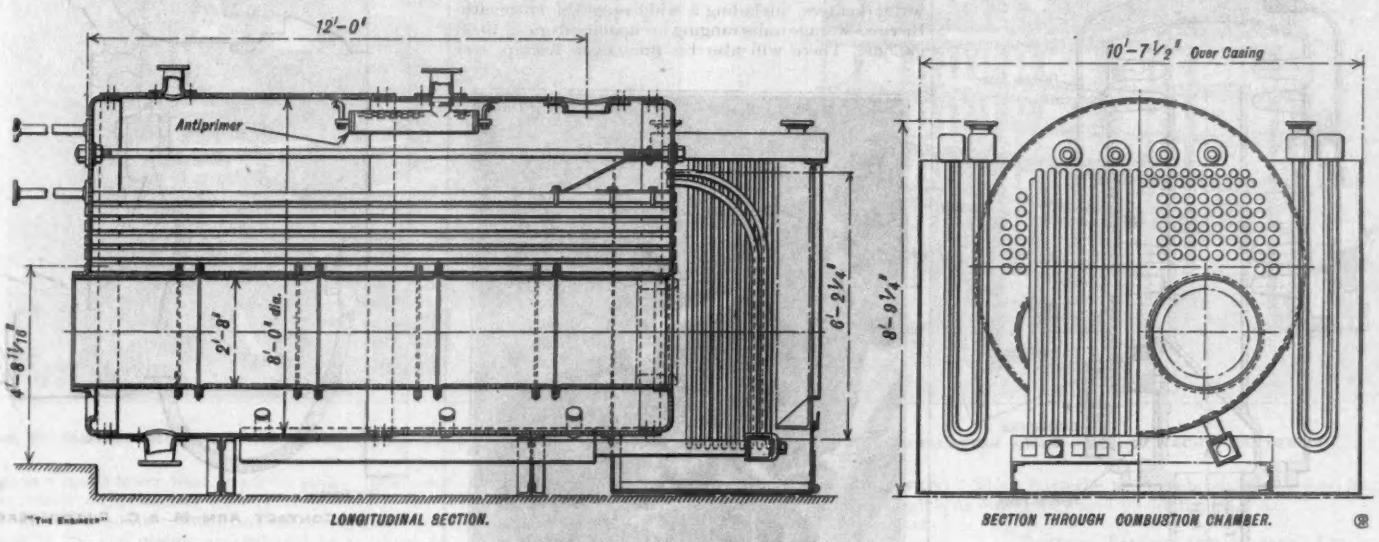

FIG. 13—HORIZONTAL BOILER—DANKS

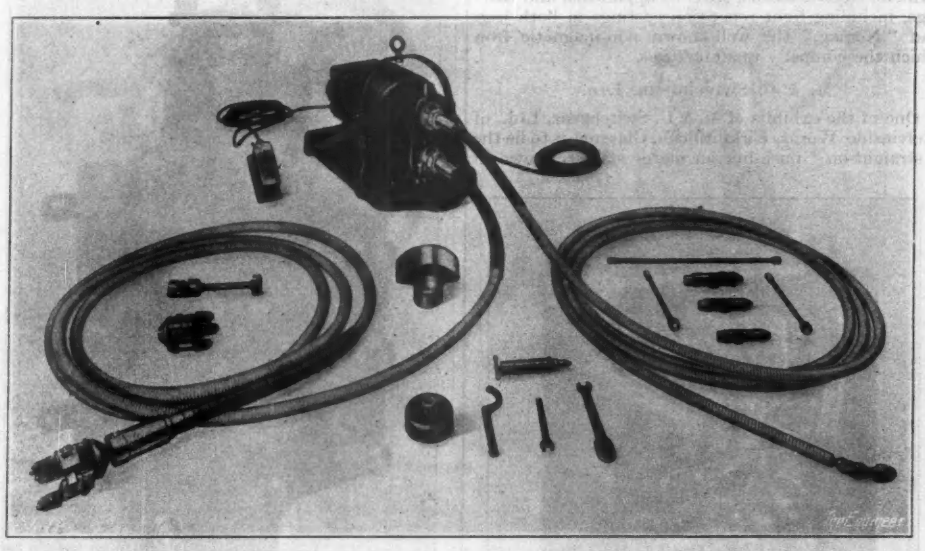

FIG. 14—TWIN-DRIVE ELECTRIC TUBE CLEANER—BABCOCK

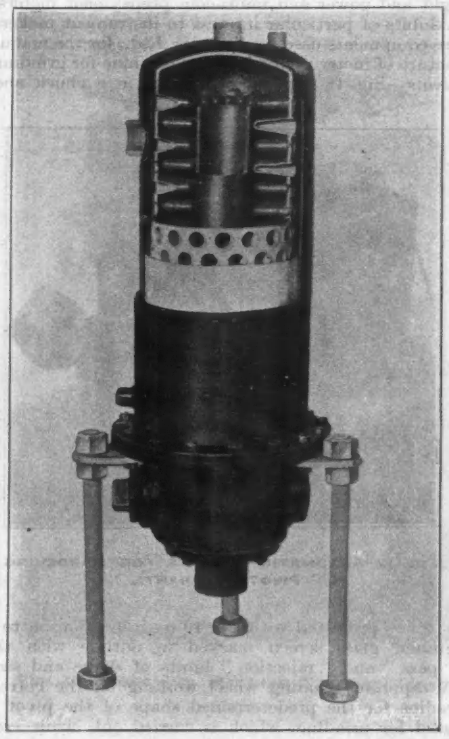

FIG. 15—THIMBLE TUBE BOILER—CLARKSON

comparatively small for its output, and a useful feature is a space of 18in. between the inner and outer shells which allows for easy examination and cleaning of the water spaces. On the fire side of the boiler the whole of the tubes can be quickly cleaned after removing the central core. The whole exhibit shows

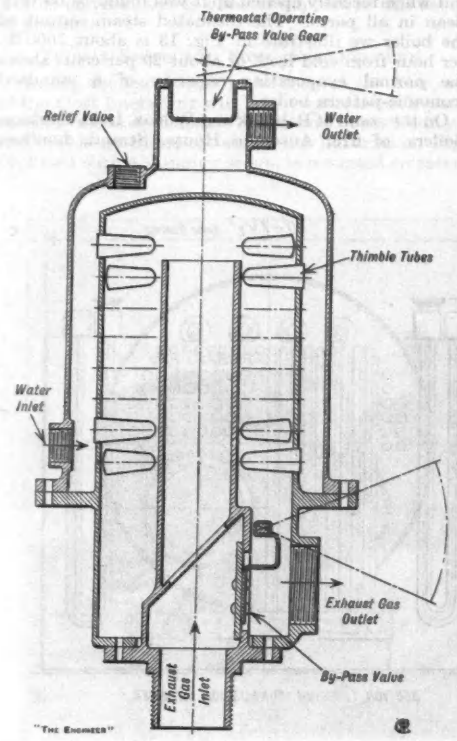

FIG. 16—THIMBLE TUBE BOILER—CLARKSON

the development of the thimble-tube principle of design in which the firm claims to be the pioneer.

FERRANTI, LTD.

House service meters of various kinds and for A.C. and D.C. supplies will be shown by Ferranti, Ltd., of Hollinwood, Lancs. In the prepayment range there is a special meter for hotel bedroom use with resetting mechanism, to enable the switch to be opened after the departure of each guest. There will also be light and power and multi-coin prepayment meters. Exhibits of particular interest to instrument makers are equipments used by Ferranti, Ltd., for the manufacture of meter pivots. In the machine for grinding pivots—Fig. 18—the pivot is placed in a chuck and

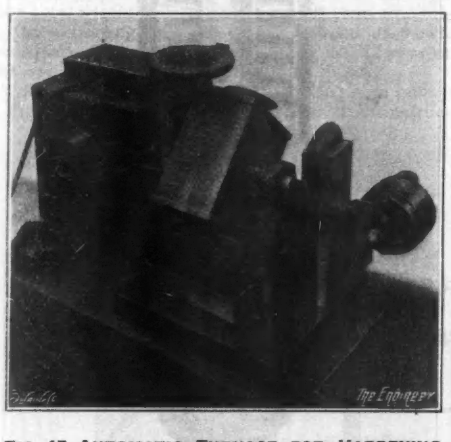

FIG. 17—AUTOMATIC FURNACE FOR HARDENING PIVOTS—FERRANTI

is micro-projected with a ×40 magnification on to a ground glass screen marked in outline with the "pass" and "rejection" limits of shape and size. A sapphire grinding wheel working on the correct radius for the predetermined shape of the pivot is used for grinding, which is carried out, while continuous observation is made of the micro-projected image.

The small furnace for hardening the pivots—Fig. 17—consists of a duplex furnace rotated through gearing by an electric motor. The pivots to be hardened are placed in a magazine connected to the same gearing and are dropped at predetermined intervals into the furnace, in which they are quickly raised to the requisite temperature. They are then automatically ejected into a water bath and two other pivots take their place in the furnace.

There will be a wide range of 2½in. indicating instruments for the measurement of current and pressure from the smallest to the highest values. Electrostatic voltmeters of small size are suitable for the measurement of pressures up to 12,000 volts. There will also be pocket type multi-range test sets for a wide range of measurements on both A.C. and D.C. circuits, a thermal maximum demand ammeter for use in sub-stations, miniature current transformers, and all types of Ferranti switchboard instruments.

The transformer exhibits will show the structural details and this kind of equipment and the operating principles of transformer voltage control gear, such as tap-changing gear. Among these exhibits there is to be a moving coil regulator, a tail end booster, a mercury tap-changing equipment, and a surge absorber. A new moving coil regulator of the concentric coil type has very low losses and is designed to withstand the internal stresses resulting from short circuits.

Domestic exhibits will consist of electric fires and water heaters, including a wide range of automatic thermal storage units ranging in capacity from 1½ to 60 gallons. There will also be immersion heaters and

FIG. 18—MACHINE FOR GRINDING PIVOTS —FERRANTI

circulator units for converting existing hot water systems to the electric system, and the Ferranti "Thermolator" with the "adjustostat" for controlling the water temperature within predetermined limits. Other exhibits are to consist of bell ringing transformers, electric clocks, wireless apparatus, and castings, including light repetition castings in both iron and "Nomag," the well-known non-magnetic iron which the company manufactures.

M. & C. SWITCHGEAR, LTD.

One of the exhibits of M. & C. Switchgear, Ltd., of Kelvinside Works, Kirkintilloch, Glasgow, is to be the "straight-on" push-button motor starter, shown in

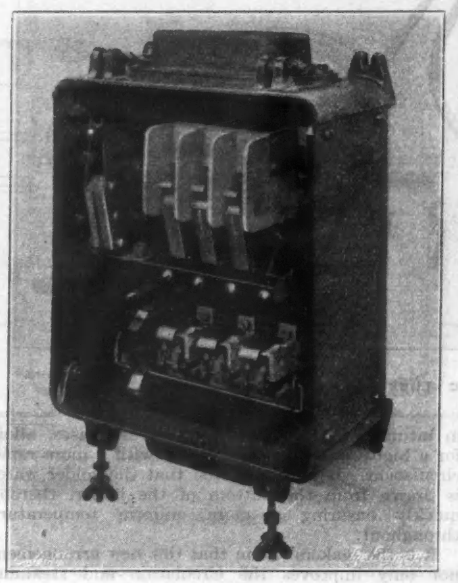

FIG. 19—PUSH BUTTON MOTOR STARTER —M. & C. SWITCHGEAR

Fig. 19. Its constant rated capacity is 30 ampères, and it is capable of starting motors of the following ratings and with a standstill current up to 100 ampères:—5 h.p., 220/250 volts; 10 h.p., 400/440 volts; 15 h.p., 600 volts. The starter comprises a totally enclosed three-phase contactor, and three-pole thermal over-current trips. The "start" and "stop" contacts are supported on the main base, whilst the push-buttons alone are assembled in the cover. All the live parts are carried on the base mounted in the case. The contactor has three identical contact arms (Fig. 20), and an auxiliary

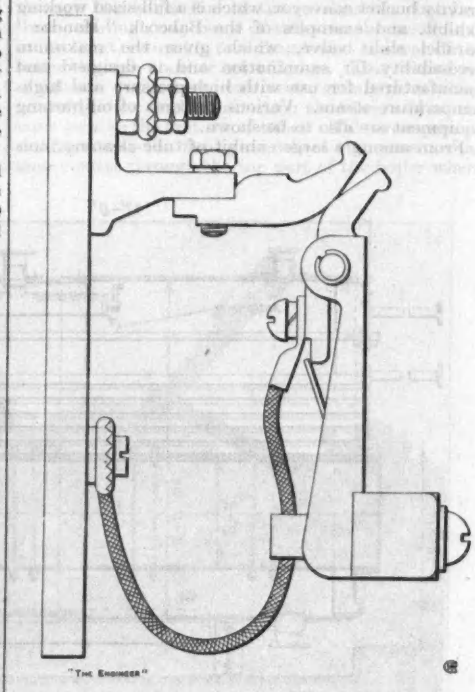

FIG. 20—CONTACT ARM—M. & C. SWITCHGEAR

switch for maintaining the operating coil circuit, the fixed contacts consisting of rigid brass sections with a hard-drawn copper tip of liberal proportions, whilst the moving contacts consist of pressed brass channel section arms, enclosing the steel pressure spring, which controls the copper contact tip, which corresponds with the fixed tip.

All the contacts are arranged so that the making and breaking point is remote from the operating position, a feature which is claimed to be unusual in small-capacity breakers. The contact arms are mounted on a substantial moulded bakelite cross bar. The operating coil is wound on a moulded bakelite bobbin, and is said to have a lower tem-

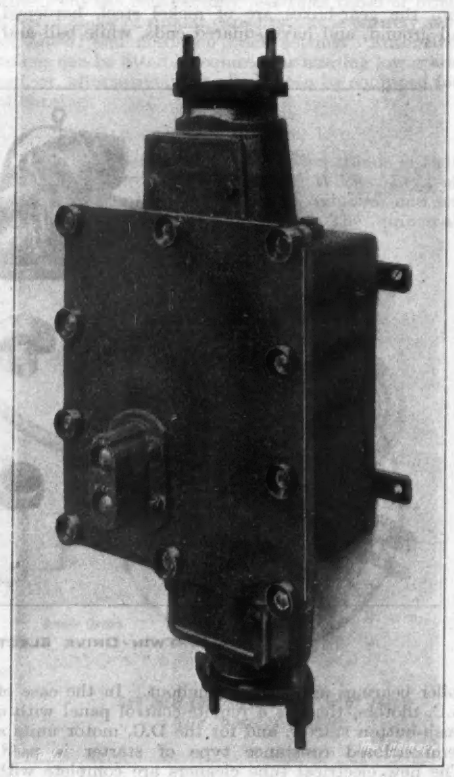

FIG. 21—FLAMEPROOF PUSH BUTTON STARTER M. & C. SWITCHGEAR

perature rise and minimum operating voltage than those called for in B.S. Specification No. 155. Easily removable arc shields are provided, although the contactor will rupture normal standstill currents without them. In the event of it being necessary to remove the operating coil, it is made accessible by withdrawing a split pin from the stop that limits the travel of the moving parts, which can then be lowered when the coil can readily be removed.

As the bi-metallic strip of the thermal over-current trips in each phase does not carry current, the same relatively heavy section is used throughout the whole range of horse-power ratings, and it cannot be fired or burnt out. The heating elements are composed of an alloy that has proved to be the best suited for the purpose. They have a high melting point, and it is said that they do not deteriorate under the conditions of repeated heating and cooling. They are enclosed in fireproof troughs, and are claimed to give

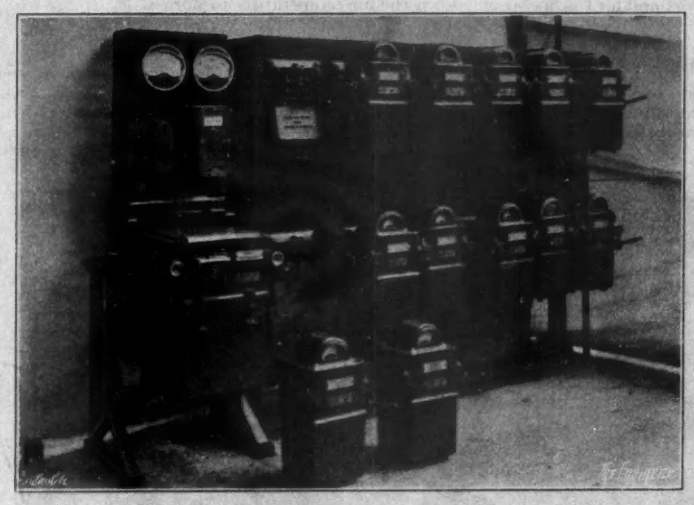

FIG. 22—CUBICLE MOUNTED OIL CIRCUIT BREAKERS—M. AND C. SWITCHGEAR

rise to a much lower watt loss than usual. Each unit has three adjustments, and is complete in itself. As the three units operate one trip switch, the contacts in the coil circuit are reduced to a minimum. The overload release gives a time lag approximately in inverse proportion to the overload. After tripping, the over-current release must be reset by hand, and if the tripping overload persists after the resetting, the release will trip with a shorter time lag which will persist until the overload is removed.

The start and stop push-buttons mounted on the cover actuate contacts mounted on the base supporting the contactor, &c., and as the "stop" button also serves as the resetting device for the over-current trips, the starting switch cannot be held in against an overload. An isolating switch is incorporated when called for. Three types of enclosures are available, the totally enclosed type, the "hose-

FIG. 23—HIGH CANDLE-POWER CAP LAMP—BATTERIES

proof" type for use in all places in which protection against water is essential, and the flameproof type, as shown in Fig. 21.

The metal-clad oil break switch units, shown in Fig. 22, have been designed for general industrial and sub-station service. In some respects they exceed the requirements of British specification No. 116—1929. The breakers are of the double-break type, *i.e.*, two parallel breaks per phase occur simultaneously. They are obtainable in sizes ranging from 100 to 800 ampères, and may be mounted together to form a switchboard, as shown. Everything, including the trip solenoids, is within the enclosure. The oil circuit breakers are of the true loose-handle type, and with the releases fitted cannot be held in the closed position during over-current or under-voltage conditions. The switch is closed by a side or front lever, according to type, which also serves for rapidly opening the breaker. The motion is transmitted through toggle mechanism and automatic opening is effected by a tripping bar operating on a case-hardened steel catch holding the toggle. Special attention has been paid to the design of the contacts, floor mounting or as draw-out units provided with bus-bar chambers and floor-mounting pedestals suitable for use as single units or for building switchboards.

BATTERIES, LTD.

High candle-power miners' hand lamps incorporating the "Nife" nickel-cadmium-alkaline accumulator and high candle-power cap lamps with the same type of battery will be seen on the stand of Batteries, Ltd., of Hunt End Works, Redditch. Both types of these lamps, which are shown in Figs. 23 and 24 respectively, have been designed to comply with the new mine lighting regulations and with a view to obtaining the maximum amount of light from equipment of small size and weight consistent with

FIG. 24—MINER'S HAND LAMP—BATTERIES

robust construction. The lower part of the hand lamp contains the battery and a strong drop forging screwed on to the upper end carries the bell glass, &c. Both the cap and hand lamp batteries are fitted with mushroom-shaped solid terminals, which enable the batteries to be charged in a hanging position and thus to eliminate possibility of corrosion whilst on the charging rack. The batteries are also provided with electrolyte level indicators, which greatly facilitates topping up with distilled water.

A complete charging and maintenance equipment, as installed in a typical lamp room, will be on view. The equipment includes the "Nife" charging rack, as shown in Fig. 25, which is proof against current leakage and consequent corrosion. In the construction of these racks no cables or soldered joints are used. The complete unit, including the instrument panels, is composed of steel, which is either painted or cadmium or nickel-plated. Compared with racks having porcelain trays, contact fingers, &c., the maintenance of these steel racks is claimed to be negligible. The ease with which the "Nife" opening magnet and semi-automatic topping up apparatus can be operated will be demonstrated, and the exhibit should prove of considerable interest to those associated with mines.

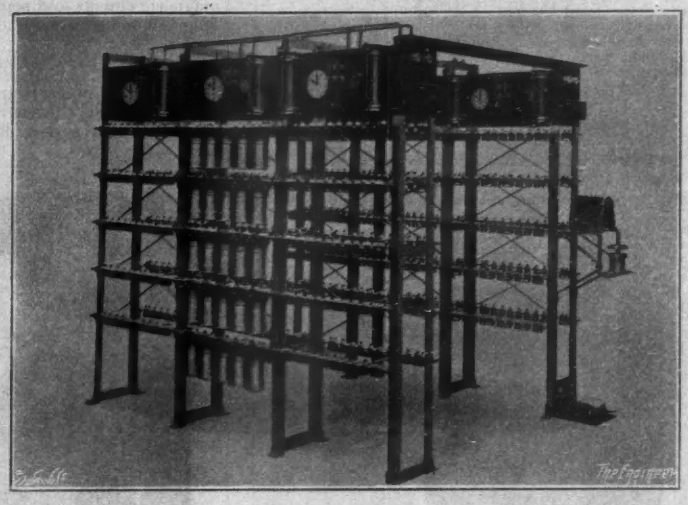

FIG. 25—INSTALLATION OF CHARGING RACKS—BATTERIES

"Nife" batteries will also be shown for such purposes as emergency and yacht lighting, &c.

TAYLOR, TAYLOR AND HOBSON, LTD.

The Javelin etching machines made by Taylor, Taylor and Hobson, Ltd., of Leicester, are already well known. They are used for such purposes as the etching of names on finished motor car components, bicycle cranks, aero-engine components, and especially finished stainless steel knives. The method has the advantage that the names can be etched on the finished product, and, so the makers of the machine state, it has largely superseded the acid etching of stainless steel cutlery in Sheffield where knives are now marked after being polished and finished and with their handles attached. Javelin etchers are to be exhibited at Birmingham for use in conjunction with the engraving machines made by the firm, together

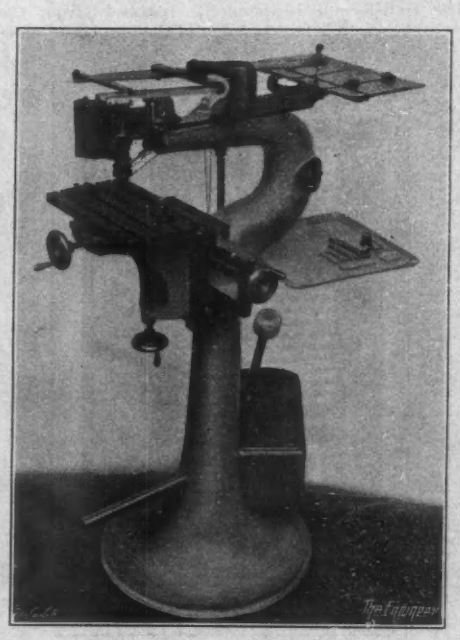

FIG. 26—ENGRAVING MACHINE—TAYLOR, HOBSON

with the resistance etcher which can be used either free-hand or in the engraving machine. This resistance etcher is designed for comparatively heavy marking on tools, gauges, &c.

But undoubtedly the tool which will receive most attention on the stand is the new "C X" engraving machine, illustrated in Fig. 26. It is suited to the engraving of large nameplates and panels, such as coffin plates, and other work where a bold type of engraving is required. Its general construction is similar to the "C" and "C B" machines by the same makers, but it is provided with a larger worktable, copyholders, and pantograph. The cutter spindle is mounted in ball bearings and forms a detachable unit. Its standard taper hole receives the standard cutters supplied for use with Taylor

Hobson machines, and the machine is driven by a motor mounted on the base. The following table gives some particulars of this interesting machine :—

Reductions marked on pantograph	2, 3, 4, 6, 8, 10, 12, 14, 16
Largest copyholders normally supplied	16in. by 7½in. or 20in. by 4½in.
Space covered by cutter at one setting with least reduction (2 : 1)	4½in. dia. circle or 8in. by 4½in. or 11½in. by 2½in.
Size of work table	15in. by 8in.
Screw movement along machine frame	14in.
Cross movement	6in.
Vertical movement	6in.
Maximum distances—	
Cutter to column horizontally	19½in.
Cutter to table vertically	6in.
Cutter to top of saddle carrying slide rest on machine frame	3½in.

WESTINGHOUSE BRAKE AND SIGNAL COMPANY.

The strides that have recently been made in the development of the metal rectifier for industrial purposes, notably in connection with heavy current low voltage and high voltage low current applications, will be exemplified by the exhibits of the Westinghouse Brake and Signal Company, of 82, York-road, King's Cross, N.1. One of the exhibits is a 1000-ampère, 6-volt plating rectifier, which is shown in Fig. 27. The transformer is mounted separately from the rectifier, which is fan cooled, and the number of units

FIG. 27—PLATING RECTIFIER—WESTINGHOUSE

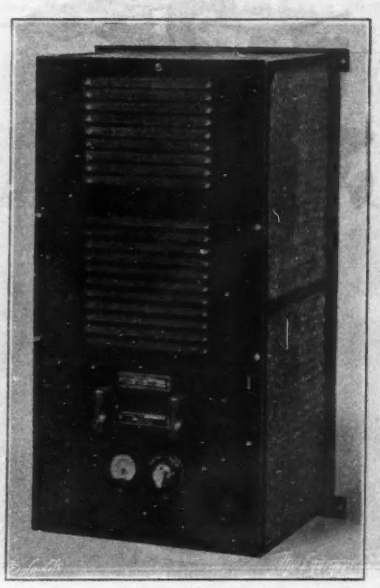

FIG. 28—ELECTRIC VEHICLE BATTERY CHARGER—WESTINGHOUSE

required and the space occupied by the rectifier are consequently reduced.

Among other exhibits will be a rectifier—Fig. 28—for charging the batteries of electric vehicles. It is suitable for charging a thirty-cell battery at 20/10 ampères, and as it is entirely automatic all that is necessary when it is desired to charge a battery is to connect a three-pin plug to the vehicle socket. At the end of the charge the rectifier is switched off by contacts on the ampère-hour meter. Normally the charge has a natural taper, starting at 20 ampères and tailing off to 10 ampères, but an equalising switch is provided for giving a half charge over the week-end. The chargers are made singly or in units for three, six, or twelve vehicles, the largest Westinghouse set so far made consisting of six two-circuit units for charging forty-four-cell batteries at 40/20 ampères. A high-voltage rectifier for electrostatic precipitation will be shown, also rectifiers for supplying D.C. to magnetic chucks and separators and for the operation of telephone systems.

SERCK RADIATORS, LTD.

The firm of Serck Radiators, Ltd., of Birmingham, intends to show, this year, a collection of heat transfer apparatus of all types. Radiators for both lubricating oil and for cooling water are to be shown for use with internal combustion engines of all types from that for the aeroplane to the portable petrol engine set, and, in addition, models for industrial air compressor units. There will be a series of heat exchangers using the Serck patented copper-nickel alloy tubes, which readily cover themselves with a protective scale against the attack of acids, &c., when used in connection with chemical plants. Air blast coolers will also be exhibited for cooling transformer oil or mercury arc rectifiers. In addition, this firm will be exhibiting a range of feed-water heaters for use with high-pressure steam, one of which is shown in Fig. 29, undergoing test, and a range of oil coolers for use in continuous-quenching plant, power stations, &c. There will also be a sectional-type radiator for industrial use. This radiator has the advantage under arduous conditions of work that any element damaged in use may be replaced by a new one without dismantling any other part of the equipment. Serck Radiators, Ltd., has now taken over the manufacture of the unit heater formerly marketed by the British Unit Heater Company, Ltd., and a range of these heaters is to be seen on the stand. In these radiators great attention has been paid to lightness and compactness. The heater unit is built up of streamlined, drawn copper tubing, threaded on a copper thermoplate pack, the unit being carried by a sheet steel shell. The difference in weight between a Serck unit heater and the equivalent cast iron radiator of orthodox type is given as 55 lb. to 9 cwt. The saving of weight makes the system of value to users whose floor carrying capacity is valuable. In summer, or when the temperature of the shop makes it desirable, the heaters will function as coolers, bringing down the air temperature to normal.

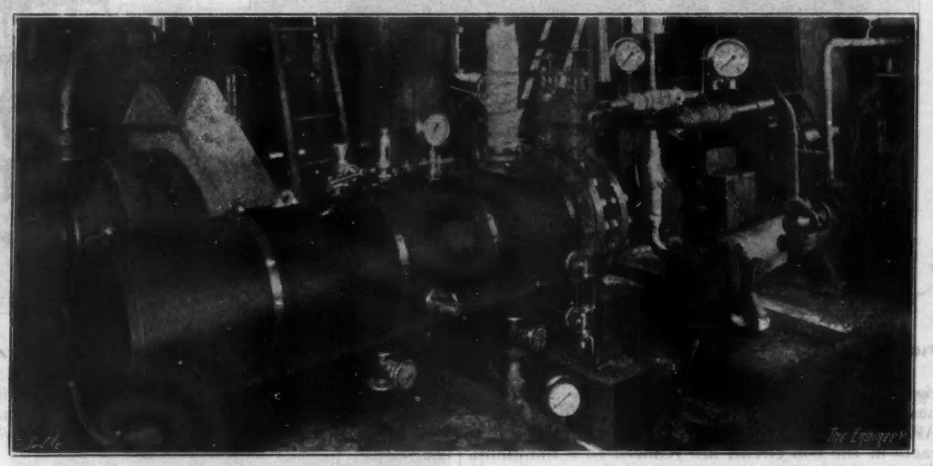

FIG. 29—FEED-WATER HEATER ON TEST—SERCK

C. H. JOHNSON AND SONS, LTD.

There will be a variety of contractors' plant and gear in the display of C. H. Johnson and Sons, Ltd., Smedley-road, Manchester, 8, amongst which there will be the simple little concrete mixer illustrated in Fig. 30. As will be readily appreciated, it comprises a light steel container of hexagonal form, which has welded joints, mounted between two wheels and furnished with a push-handle. One of the sides of the hexagon forms a door, which can be tightly locked in place, and there is an arrangement for either locking the container to the road wheels, so that they rotate together, or allowing the container to swing free. The idea is that the barrow should be loaded up with the ingredients for making concrete, and then, during the process of being wheeled to the site, the necessary mixing is effected. The operation is assisted by a number of crossed tynes in the drum. The size of the drum is 2ft. 8in. by 2ft. across the corners, and the wheels are 3ft. 6in. in diameter by 3in. across the tread.

FIG. 30—CONCRETE BARROW AND MIXER—JOHNSON

The same firm also proposes to demonstrate a tool for boring holes in the ground, for fence posts, and such like purposes, and an internal combustion tamping tool. In this machine the weight of the cylinder, &c., is thrown upwards by the explosion of the working charge, and performs its useful work on falling again. The same idea is applicable to pile driving and a number of other purposes.